PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : H04L 1/20	A1	(11) International Publication Number: WO 00/52874 (43) International Publication Date: 8 September 2000 (08.09.00)

(21) International Application Number: PCT/EP00/00754

(22) International Filing Date: 1 February 2000 (01.02.00)

(30) Priority Data:
9904351.5 26 February 1999 (26.02.99) GB

(71) Applicant: KONINKLIJKE PHILIPS ELECTRONICS N.V. [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).

(72) Inventor: FORDE, Brian, J.; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

(74) Agent: TANGENA, Antonius, G.; Internationaal Octrooibureau B.V., Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

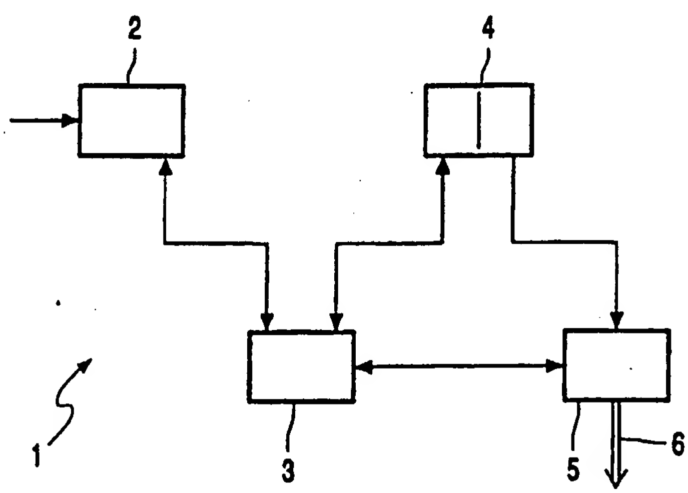
(81) Designated States: CN, JP, KR, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: COMMUNICATION CHANNEL QUALITY INDICATOR

(57) Abstract

The quality of a communications channel carrying data packets is determined by establishing if a packet is received correctly or incorrectly. Check means (2) provides a signal to a microprocessor (3) for each correct reception event and each incorrect reception event. A value, held in a two byte counter (4) is indicative of the quality of the communications channel. For each correct reception event the value of the counter is decreased by an extent dependent on the value already held in the counter. For each incorrect reception the value of the counter is increased by an extent dependent on the value already held in the counter. When the stored counter value exceeds a preset threshold value indicating poor channel quality, a comparator (5) produces an output signal to initiate a handover operation to another communications channel.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania
AM	Armenia
AT	Austria
AU	Australia
AZ	Azerbaijan
BA	Bosnia and Herzegovina
BB	Barbados
BE	Belgium
BF	Burkina Faso
BG	Bulgaria
BJ	Benin
BR	Brazil
BY	Belarus
CA	Canada
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Côte d'Ivoire
CM	Cameroon
CN	China
CU	Cuba
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
ES	Spain
FI	Finland
FR	France
GA	Gabon
GB	United Kingdom
GE	Georgia
GH	Ghana
GN	Guinea
GR	Greece
HU	Hungary
IE	Ireland
IL	Israel
IS	Iceland
IT	Italy
JP	Japan
KE	Kenya
KG	Kyrgyzstan
KP	Democratic People's Republic of Korea
KR	Republic of Korea
KZ	Kazakstan
LC	Saint Lucia
LI	Liechtenstein
LK	Sri Lanka
LR	Liberia
LS	Lesotho
LT	Lithuania
LU	Luxembourg
LV	Latvia
MC	Monaco
MD	Republic of Moldova
MG	Madagascar
MK	The former Yugoslav Republic of Macedonia
ML	Mali
MN	Mongolia
MR	Mauritania
MW	Malawi
MX	Mexico
NE	Niger
NL	Netherlands
NO	Norway
NZ	New Zealand
PL	Poland
PT	Portugal
RO	Romania
RU	Russian Federation
SD	Sudan
SE	Sweden
SG	Singapore
SI	Slovenia
SK	Slovakia
SN	Senegal
SZ	Swaziland
TD	Chad
TG	Togo
TJ	Tajikistan
TM	Turkmenistan
TR	Turkey
TT	Trinidad and Tobago
UA	Ukraine
UG	Uganda
US	United States of America
UZ	Uzbekistan
VN	Viet Nam
YU	Yugoslavia
ZW	Zimbabwe

DESCRIPTION

COMMUNICATION CHANNEL QUALITY INDICATOR

The present invention relates to a method and apparatus for determining quality indicators for communication channels. In particular the present invention relates to determining whether individual channels of a communications system should be used for the communication of information.

In communication systems information is transferred over communication channels established on various types of communication links. The quality of these links affects the performance of the communication channels and the quality can be specified in a number of ways. One way to determine the quality of a communication channel, especially where information is digital and transferred in packets, is to take account of the number of successful and unsuccessful (failed) reception events for information carried along the communication channel. The exact manner of detecting successful or unsuccessful receptions can vary, but one way is to include error checking information with transmitted packets so that a determination may be made at the receiving side as to whether the received packets have been received correctly.

Communication links are likely to be subject to interference from time to time and intermittent reception failures will occur. Reception failures may be a particular problem where the communication link is a radio link, for example, in a cellular communication system between a mobile terminal and a fixed terminal.

Systems that use wireless links can often establish such links on a number of different system channels. If the system is a cellular system the links can be established with different radio end points. In such systems it is beneficial to monitor the quality of a wireless link that has already been established because if it is unsatisfactory, a different wireless link can be set up on a different system channel and/or to a different radio end point that will

provide a superior quality wireless link and therefore a superior quality communications channel.

Intermittent reception failures are to be expected and although they are undesirable, they may not present any serious problems and are not necessarily an indication that the channel quality is poor. Conversely, periodic repeating reception failures or high levels of random reception failures are an indication that channel quality is inferior and may cause problems such as a reduction in communication channel bandwidth.

It is therefore necessary to monitor the quality of a communication link to obtain an indication of whether it is suitable for supporting a communication channel. The indication should account for the fact that a single packet failure by itself does not determine that the channel is of poor quality. However, periodic packet reception failures or high levels of random packet reception failures should be reflected in the indication because such failures do indicate a poor quality link.

In order to obtain an indication of this type, a history of link quality based on the number of communication channel packet reception successes and failures can be used to determine the link quality.

A simple approach for doing this is to use a counter which is incremented each time a packet is received correctly and decremented each time a packet is received incorrectly. A similar type of counter is mentioned in US-A-5 271 011, which relates to a digital audio muting system for disabling the output of a data transmission system when a relatively high error rate is detected. The counter of the mutihg system is incremented when an error is detected and decremented by an amount at a programmable time interval. The counter may be incremented by a greater amount when more serious errors are detected. A threshold value can then be established for comparing to the value held in the counter. If the value held in the counter is larger than the threshold value, the quality can be deemed to be bad; if the value held in the counter is smaller than the threshold value, the quality can be deemed to be good.

However, this approach does not take account of the time at which packet reception fails. For example, if a regular periodic failure were to occur for every fifth packet transmitted, the quality of the communications channel is poor, due to interference of the communications link. Such a simple counter may not reflect this, even if a packet reception failure is given more weight than the packet reception success. In fact, for any counter which adds a first value for packet reception failure and subtracts a second value for packet reception success, the resulting value of the counter will decrease continuously (tend towards zero) in the presence of periodic or random errors, where the average error ratio is less than the first value divided by the sum of the first and second values. Similarly, the resulting value of the counter will increase continuously (tend towards the maximum value of the counter) in the presence of periodic or random errors, where the average error ratio is greater than the first value divided by the sum of the first and second values.

It is an object of the present invention to provide a mechanism for reliably evaluating the quality or average error ratio of a communications channel based on the number of packets that are transferred over the channel either successfully or unsuccessfully.

It is another object of the present invention that the mechanism should not place an undue burden on system resources in terms of processing or storage capacity requirements.

In accordance with the first aspect of the present invention there is provided apparatus for determining the quality of a communications channel carrying information units for reception, said apparatus having:

input means for receiving information identifying if correct or incorrect reception of transmissions on the communications channel occurred;

storage means for storing data indicative of the quality of the communications channel; and

update means coupled with said input means for performing a first update operation to update the stored data in the event of incorrect reception

of information units and for performing a second update operation to update the stored data in the event of correct reception of information units,

wherein the stored data is updated to an extent dependent on the data stored by the storage means immediately before the occurrence of a said event.

Because the stored data is updated to an extent dependent on the data stored before a said event, the data stored in the updated form will reflect the history of the stored data. Because the history is reflected, incorrect reception events in the form of intermittent single packet failures will not dominate the stored data. However, a plurality of incorrect reception events in the form of repetitive periodic or high levels of random packet failures will begin to affect the stored data. Advantageously, because the history of the stored data is considered, more recent incorrect reception events can affect the stored data to a greater extent than incorrect reception events that occurred sometime ago. This means that the use of a quality history can be made to weigh more recent packet reception failures in favour of reception failures that occurred some time ago.

Preferably the stored data includes a value, the first update operation increases the stored value and the second update operation decreases the stored value, such that the value stored by the storage means increases or decreases with each operation by an amount dependent on the value stored immediately before the occurrence of a said event. Alternatively, the first update operation may decrease the stored value and the second update operation increase the stored value, such that the value stored by the storage means decreases or increases with each operation by an amount dependent on the value stored immediately before the occurrence of a said event.

The storage means may include a two byte counter for holding a value indicative of the quality of the communications channel. If the stored data includes a value and the first update operation increases the stored value for each event of incorrect reception, the counter may be incremented by a value obtained by subtracting the value that is held in the high byte of the counter immediately before the event from 128.

If the stored data includes the value and the second update operation decreases the stored value for each event of correct reception, the counter may be decremented by a value obtained by subtracting the value that is held in the high byte of the counter immediately before the event.

If the data does include a value, the quality of the communications channel may be determined by comparing the stored value of the storage means with a predetermined threshold value and determining the quality from the difference therebetween.

In accordance with a second aspect of the present invention there is provided a method for determining the quality of a communications channel carrying information units for reception, said method comprising the steps of:

monitoring if correct reception of information transferred by the communications channel occurred;

storing data indicative of the quality of the communications channel; and

performing a first update operation to update the stored data in the event of incorrect reception of information units otherwise performing a second update operation to update the stored data in the event of correct reception of information units,

wherein the stored data is updated to an extent dependent on the data stored immediately before the occurrence of a said event.

Other aspects and optional features of the present invention appear in the appended claims, to which reference should now be made and the disclosure of which is incorporated herein by reference.

Embodiments of the present invention will now be described with reference to the accompanying drawings in which

Figure 1 shows a functional representation of apparatus suitable to implement the present invention;

Figure 2 shows a first example of the performance of a quality indicator of the present invention under a first set of conditions;

Figure 3 shows a second example of the performance of a quality indicator of the present invention under a second set of conditions; and

Figure 4 shows a third example of the performance of a quality indicator of the present invention under a third set of conditions.

Referring to Figure 1 apparatus 1 embodying the present invention is provided with error checking means 2 for evaluating information units in the form of data packets received over a communications channel. The error checking means establishes if a given data packet is received successfully indicating a correct reception event or unsuccessfully indicating an incorrect reception event. In this specific example a communications channel is established on a bearer of a DECT compliant telecommunications system in which case the determination that incorrect reception occurred may be made by taking into account the S-field, A-field cyclic redundancy checks (A-CRC), X-CRC and Z-field. Where B-field protected data is being transmitted, the B-CRCs can also be used. Additionally, in the case of traffic bearers, the Q1 and Q2 bits of the received packet can be used, all of which checks will be understood by the person skilled in the art. Other types of checks to test for correct reception of data packets could be performed if other communication systems are used as will also be apparent to the person skilled in the art.

As such correct and incorrect reception events are determined by checking means 2 this information is provided to a microprocessor 3 for updating a value held in a two byte counter 4 by an amount that depends on the value already held in the counter. For each determined packet reception failure (incorrect reception event) the counter 4 is incremented , under the control of the microprocessor 3, by a value of 128 decimal (80 hex) minus the high byte of the current value of the counter. For each determined packet reception success (correct reception event) the counter 4 is decremented, under the control of the microprocessor 3, by the high byte of the current value of the counter. This particular algorithm could be implemented with the following code:

```
if (reception successful)
{
        qualityCounter =- (qualityCounter / 256);
}
else
{
        qualityCounter =- (qualityCounter / 256) – 0x80;
}
```

In effect this solution is an infinite impulse response filter, with the input being a step function switching between 0 (for each successful reception event) and 80(hex), which is 128 in decimal, for an unsuccessful reception event.

The counter could be increased or decreased by different amounts depending on the required performance.

An indication of the quality of the communication channel is obtained by examining the value of the high byte of the counter. A first predefined threshold value could be set such that when the value of the high byte exceeds the threshold value the quality of the communication channel is determined to be bad. A second predetermined threshold, having a value which is the same as the first threshold value or less than the first threshold value could be set such that when the value of the high byte is below the threshold value the quality of the communications channel is determined to be good.

In those cases where the value of the counter is decreased for incorrect reception events and increased for correct reception events, the quality of the communications channel will be determined to be good when the value of the high byte exceeds the first threshold value and is determined to be bad when the value of the high byte is less than the second threshold value.

Threshold values may be altered depending on the implementation of the apparatus and indeed in some applications it may be preferable to dynamically alter the or each threshold value. Different levels of quality may

be acceptable for voice and data applications, although the maximum level of quality attainable (i.e. the minimum error ratio) should be achieved if possible.

The examining of the value of the counter 4 is performed by comparator 5 which produces a status output 6 indicating if the quality of the communications channel is good or bad.

If the apparatus is used in communications systems (optimally contained within a portable handset) that uses one or more of a number of different system channels for establishing the communications channel, the status output 6 may be used to initiate the communications system to select a different system channel than the one presently in use if the status output 6 indicates that the quality of the present communications channel is bad.

An example of such a system is a DECT compliant communications system where communication channels take the form of one or more bearers established between the portable part (portable terminal) and the fixed part (fixed terminal). If a bearer is determined to have poor quality as indicated by the status output 6, a handover attempt to a different bearer is initiated. In some cases, if the communications system is a cellular system, the handover of the communications channel may be to a different radio termination of the fixed terminal.

In one implementation the handover operation may proceed in co-operation with the mechanism described in our co-pending WO patent application entitled 'Cellular Communication System Handover', claiming priority from UK patent application number GB 9 904 349.9 the teaching of which is incorporated herein by reference. Furthermore, information relating to activity on the DECT compliant system channels may be monitored and stored as described in our co-pending WO patent application entitled 'Wireless Communication Channel Management', claiming priority from UK patent application number GB 9 904 348.1 the teaching of which is also incorporated herein by reference.

Figure 2 is a graph which illustrates the general operation of the apparatus using a value to indicate the quality of a communications channel. The y-axis is used to indicate the value, with higher values indicating poor

quality and lower values indicating better quality. The x-axis represents time and here it is assumed that reception events occur at regular periods, irrespective of the nature of the reception event. Line 21 plotted on the graph shows the quality value if every reception event over a long period is successful. Because every event is successful, the value should tend to zero in this example and it will be noted that whatever the starting value, the quality indicator tends to zero. Similarly line 22 plotted on the graph shows the quality value if reception events are normally unsuccessful. The quality indicator tends to a value representative of the actual quality so at any given level of quality, the graph shows how packet reception success or failure will affect the resulting value.

For example, at a low value of quality indicator, when the bearer quality is good, packet reception failure will cause a rapid increase in the value, while packet reception success has little or no effect. At the other extreme, where the quality indicator value is high, packet reception success has a greater influence on the result than packet reception failure.

The graph shown in Figure 3 has the same axes as the graph of Figure 2, but the plot 31 shows the effect of regular reception failure on the quality indicator value. The quality indicator tends towards a value which reflects the frequency of packet failure. The example used to generate the graph assumes that every 16th packet reception fails.

The graph of Figure 4 contains a plot 41 which shows the effect of a burst failure (a series of packet reception failures) on the quality indicator value. The example used to generate this graph assumes that the underlying error rate is one where 1 in 16 packet receptions fail (as in Figure 2). A burst error (of 16 packet reception failures) occurs, and thereafter the underlying error rate is restored.

It will be apparent to the person skilled in the art that other types of storage may be used, either instead of or in addition to a two byte counter. For example, the counter may store data in a different manner and it is not essential that the values stored bear similarity to values produced by an infinite impulse response filter. In any case it is desirable that the stored data should

be maintained using a small amount of storage capacity with minimal processing requirements, as is the situation when a 2-byte counter is used.

One alternative example is where the storage means may include a counter for holding a value indicative of the quality of the communications channel. If the stored data includes a value and the first update operation increases the stored value for each event of incorrect reception, the counter may be incremented by a first fraction of the value obtained by subtracting the value that is held in the counter immediately before the event from the maximum value of the counter. Such a maximum value may be set as required but may be limited by the size of the counter. If the stored data includes the value and the second update operation decreases the stored value for each event of correct reception, the counter may be decremented by a second fraction of the value that is held in the counter immediately before the event. The size of the first fraction determines the rate at which the counter tends towards the maximum when an error occurs, and the size of the second fraction determines the rate at which the counter tends towards zero when successful reception occurs.

The opposite of this alternative example is where the stored value is increased as stated but for each event of correct reception and the stored value is decreased as stated but for each event of incorrect reception.

Where a two byte counter is used as described herein, for each event of incorrect reception the counter may be decremented by a value obtained by subtracting the value that is held in the high byte of the counter immediately before the event. For each event of correct reception the counter may be incremented by a value obtained by subtracting the value that is held in the high byte of the counter immediately before the event from 128.

Although the apparatus described is controlled by a microprocessor this is not a requirement as will also be apparent to the person skilled in the art.

From reading the present disclosure other modifications will be apparent to the person skilled in the art. Such modifications may involve other features which are already known in the design, manufacture and use of

systems and devices and component parts thereof and which may be used instead of or in addition to features already described herein.

CLAIMS

1. Apparatus for determining the quality of a communications channel carrying information units for reception, said apparatus having:

input means (2) for receiving information identifying if correct or incorrect reception of transmissions on the communications channel occurred;

storage means (4) for storing data indicative of the quality of the communications channel; and

update means (3) coupled with said input means for performing a first update operation to update the stored data in the event of incorrect reception of information units and for performing a second update operation to update the stored data in the event of correct reception of information units,

wherein the stored data is updated to an extent dependent on the data stored by the storage means (4) immediately before the occurrence of a said event.

2. Apparatus in accordance with claim 1, wherein the stored data includes a value, the first update operation increases the stored value and the second update operation decreases the stored value, such that the value stored by the storage means (4) increases or decreases with each operation by an amount dependent on the value stored immediately before the occurrence of a said event.

3. Apparatus in accordance with claim 1, wherein the stored data includes a value, the first update operation decreases the stored value and the second update operation increases the stored value, such that the value stored by the storage means (4) decreases or increases with each operation by an amount dependent on the value stored immediately before the occurrence of a said event.

4. Apparatus in accordance with claim 1, 2 or 3 wherein the storage means (4) includes a two byte counter (4).

5. Apparatus in accordance with claim 4 when appended to claim 2 wherein for each event of incorrect reception the counter (4) is incremented by a value obtained by subtracting the value that is held in the high byte of the counter immediately before the event from 128.

6. Apparatus in accordance with claim 4 or 5 when appended to claim 2 wherein for each event of correct reception the counter (4) is decremented by a value obtained by subtracting the value that is held in the high byte of the counter immediately before the event.

7. Apparatus in accordance with claim 2 or 3 wherein the quality of the communications channel is determined by comparing the stored value of the storage means (4) with a predetermined value and determining the quality from the difference therebetween.

8. Apparatus in accordance with any one of claims 4 to 6 and further comprising comparator means (5) wherein the quality of the communications channel is determined by comparing the value of the high byte of the two byte counter (4) with a predetermined threshold value, wherein the channel quality is determined to be good when the stored value is below a first predetermined threshold value·otherwise the channel quality is determined to be poor when the stored value is above a second predetermined threshold value.

9. Mobile communications apparatus including apparatus as claimed in any of claims 1 to 8, the communications apparatus being operable to select from one of a plurality of communications channels on the basis of their respective quality.

10. A method for determining the quality of a communications channel carrying information units for reception, said method comprising the steps of:

monitoring if correct reception of information transferred by the communications channel occurred;

storing data indicative of the quality of the communications channel; and

performing a first update operation to update the stored data in the event of incorrect reception of information units otherwise performing a second update operation to update the stored data in the event of correct reception of information units,

wherein the stored data is updated to an extent dependent on the data stored immediately before the occurrence of a said event.

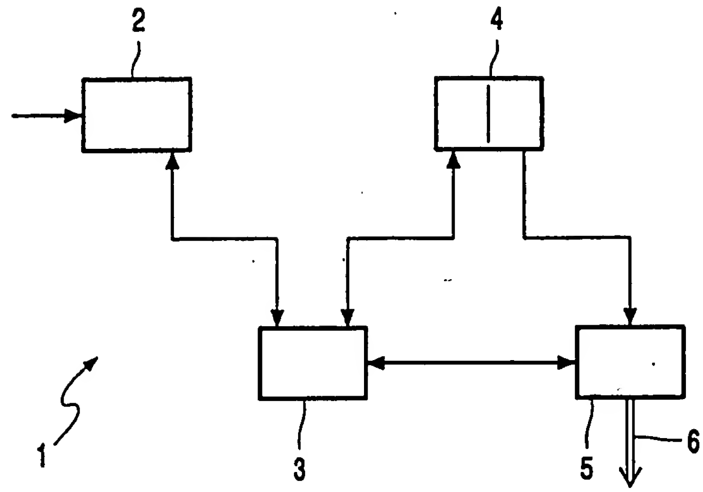


FIG. 1

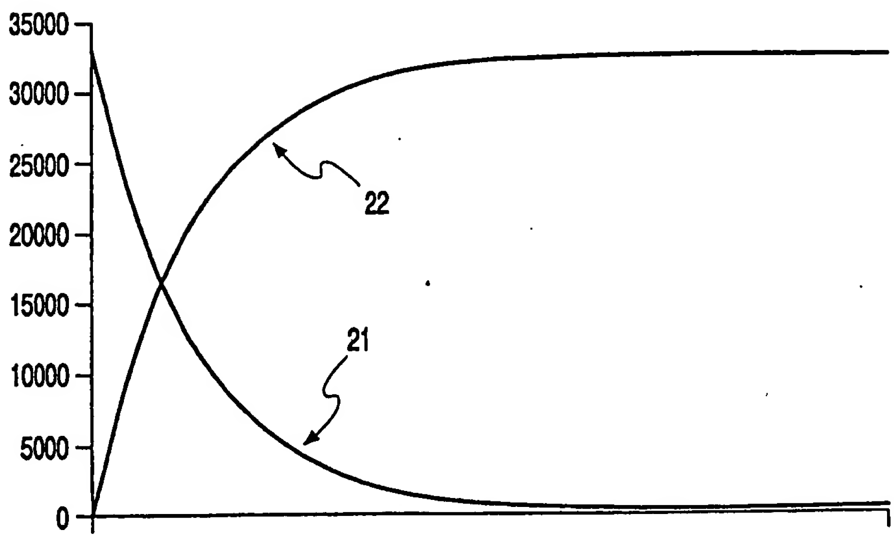


FIG. 2

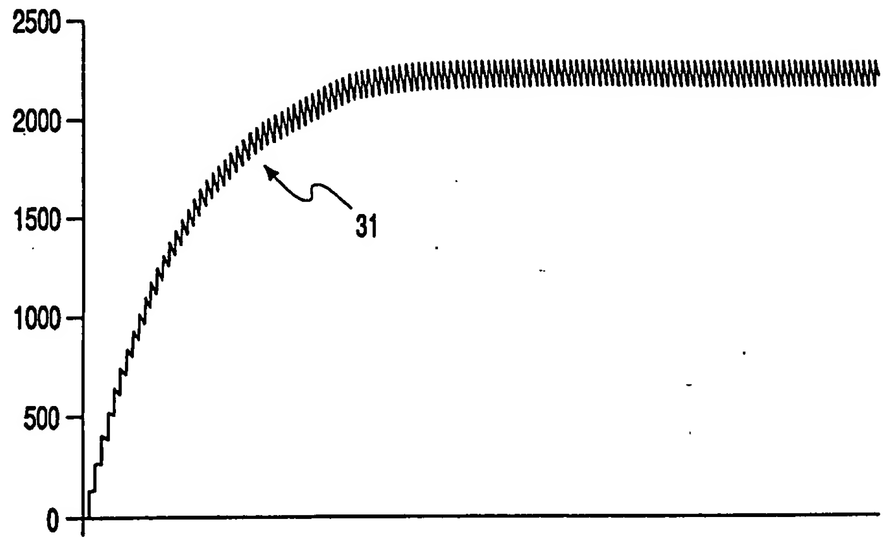

2500
2000
1500
1000
500
0
31

FIG. 3

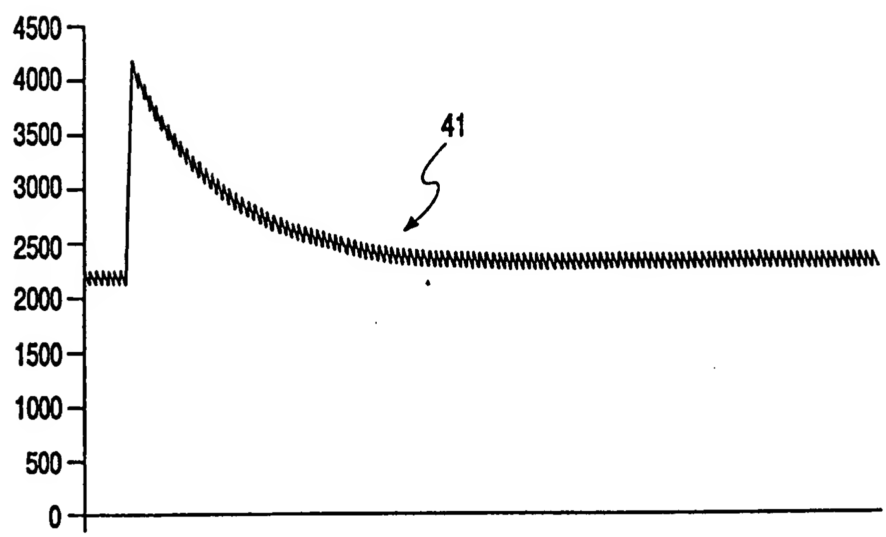

4500
4000
3500
3000
2500
2000
1500
1000
500
0
41

FIG. 4

INTERNATIONAL SEARCH REPORT

Intc ioi .pplication No
PCT/EP 00/00754

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L1/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 599 515 A (AMERICAN TELEPHONE & TELEGRAPH) 1 June 1994 (1994-06-01) page 4, line 9 - line 33 page 6, line 20 - line 29 figures 2,5	1-4,7,9, 10
X	WO 96 20548 A (CHAPMAN STEVEN JOHN ;DOWDEN ANTOINETTE (GB); BRITISH TELECOMM (GB)) 4 July 1996 (1996-07-04) abstract figure 2	1,10
A	US 5 271 011 A (MCMULLAN JR JAY C ET AL) 14 December 1993 (1993-12-14) cited in the application abstract column 3, line 17 -column 4, line 24 figure 4	1-10

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 June 2000	28/06/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Toumpoulidis, T

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Intl Ional Application No
PCT/EP 00/00754

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0599515 A	01-06-1994	US 5513185 A	30-04-1996
		CA 2105544 A,C	24-05-1994
		DE 69328468 D	31-05-2000
		JP 2813119 B	22-10-1998
		JP 6216972 A	05-08-1994
WO 9620548 A	04-07-1996	AU 690403 B	23-04-1998
		AU 4309796 A	19-07-1996
		AU 688652 B	12-03-1998
		AU 4309896 A	19-07-1996
		CA 2205421 A	04-07-1996
		CA 2205603 A	04-07-1996
		CN 1171180 A	21-01-1998
		CN 1171181 A	21-01-1998
		EP 0799540 A	08-10-1997
		EP 0799541 A	08-10-1997
		FI 972599 A	18-06-1997
		FI 972600 A	18-06-1997
		WO 9620549 A	04-07-1996
		JP 10512109 T	17-11-1998
		JP 10511524 T	04-11-1998
		NO 972884 A	20-06-1997
		NO 972885 A	20-06-1997
		NZ 297844 A	24-10-1997
		NZ 297845 A	24-10-1997
		US 5923247 A	13-07-1999
		US 6018300 A	25-01-2000
US 5271011 A	14-12-1993	AU 3805193 A	21-10-1993
		CN 1081038 A	19-01-1994
		MX 9301468 A	31-01-1994
		WO 9319545 A	30-09-1993